Acquired Vertical Binocular Diplopia Following a Rugby Match

Case Example

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Case J.S.

- CC: Double vision
- HPI: 23 y/o white male
  - H/O Right orbital floor fracture Feb 2009 (assaulted)
  - Repaired with silicone sheet and microscrew fixation
  - Some persistent vertical diplopia in downgaze post-operatively, not interfering with activities  observed
  - Stable until 3 weeks prior to re-presentation Oct 2011...

Case J.S.

- Hit to face during Rugby match
- Worsened vertical diplopia in primary gaze shortly thereafter
- No loss of vision
- No nausea or vomiting
DDx Acquired Vertical Binocular Diplopia

- Cranial Nerve III Palsy
- Cranial Nerve IV Palsy
- Skew Deviation (central vestibular disturbance)
- Brainstem or cerebellar injury
- Multiple sclerosis
- Head trauma
- Extra-ocular Muscle Restriction (e.g. fracture, inflammation, mass)
- Neuromuscular Junction Pathology (e.g. myasthenia)

Sashank Prasad, Nicholas J. Volpe and Madhura A. Tamhankar. Neurology 2009;72;e93

PMHx

- Reactive Airway Disease
- Obsessive Compulsive Disorder
- Attention Deficit Disorder
- Varicocele

Medications

- Lexapro
FHx & SHx

- Art Student
- Denies smoking
- No family history of eye disorders

POHx

- Right orbital floor blowout fracture Feb 2009 s/p assault
- Per notes "Restricted motility in upgaze and downgaze OD"
- Repaired with silicone sheet and microscrew fixation
- Physiologic cupping OU

Exam

V

20/20
20/20

T

17

17

- Pupils: 4 →
- Orbits soft to retropulsion OU
- MRD1: +0.5 OD, +3 OS
- Hertel Exophthalmometry:
  - Base 91
  - OD 16
  - OS 15
Motility

SLE

L/L/A: Grossly WNL OU
C/S: W/Q OU
K: Clear OU
AC: D/Q OU
I: Flat OU, WNL OU
L: Clear OU

DFE

• ON pink & sharp OU
• C/D: 0.45 OU
• Mac: Retinal Striae OD, Flat OS
• Vessels: WNL OU
• Vitreous: Clear OU
• Periphery: OD: 4 DA inferior globe indentation, OS: WNL
Right Eye

- Mild exophthalmos
- Hyperglobus
- Limitation of infraduction
- Macular striae and inferior globe indentation
- History of prior orbital fracture repair
- History of new trauma

Thoughts?

Perimetry

- HVF 24-2 from patient’s optometrist office was normal

![Perimetry Image]
Diagnosis:

- Inflammatory capsule around silicone sheet with likely intracapsular hemorrhage brought on by trauma.
  - "hematic cyst"
  - "chocolate cyst"

Treatment:

- Removal of silicone implant and drainage of cyst / blood

7/12/12
Delayed Chocolate Cyst After Blowout Fracture

Case Report:
- 42 y/o female
- Orbital floor fracture repaired age 21
- 11 year hx: recurrent RLL edema and hypesthesia, diplopia, proptosis
- Eventual removal of silicone sheet
  - Apparently migrated, abrading infraorbital NV bundle
  - Thick brown fluid recovered
- Symptoms resolved completely


- 4 cases of hemorrhage around alloplastic implant
  - 3 silicone
  - 1 unknown
- Occurred 5 to 18 years post-operatively
- All presented with diplopia / hyperglobus developing over months
- 3 out of 4 were removed; 1 managed conservatively
CLINICAL RESEARCH

Delayed Complications of Silicone Implants Used in Orbital Fracture Repairs

- 4 cases with delayed complications silicone orbital implants
- Occurred 1.5 to 20 years post-operatively
  - Worsening diplopia
  - Recurrent orbital cellulitis
  - Lower lid retraction with restricted upgaze
  - Orbital abscess
- Implant removal required in all cases
- Histology: significant inflammation and fibrosis around implant

Implant Options in Orbital Fracture Repair

- **Autologous:**
  - Bone (calvarial, iliac crest, rib, etc.)
  - Cartilage (nasal septum, ear)
  - Etc.
- **Alloplastic:** (some examples)
  - Titanium mesh
  - Silicone (Silastic)
  - Porous Polyethylene (Medpor, Synpor)
  - Nylon foil (SupraFOIL)
- Also: Xenografts, Bioceramics (HA), etc.


**Autologous: Bone**

- Split calvarial, iliac crest, maxilla, rib

**Advantages:** strength, rigidity, vascularization, biocompatibility

**Disadvantages:**
- Difficult to work with and shape
- Donor site morbidity
- Unpredictable resorption
- Dural tears / hemorrhage

Also: Baino, F. Biomaterials and implants for orbital floor repair. *Acta Biomaterialia* 7(2011) 3268-3286
Autologous: Cartilage

- Nasal Septum or Ear Cartilage

  - Advantages:
    - Easier to harvest than bone
    - Easier to shape
    - Lasts years (very little resorption)
    - Minimal donor site morbidity
    - Potential benefit, e.g. nasal septoplasty

  - Disadvantages:
    - Potential size limitation
    - Surgical time / donor site


Alloplastic: Titanium Mesh

- Advantages:
  - Good for large orbital defects
  - May come pre-formed
  - Rigid

- Disadvantages:
  - Rigid
  - Chronic Inflammation


Orbital Adherence Syndrome Secondary to Titanium Implant Material

- 10 patients h/o orbit fx repair using titanium mesh
- 9/10 Diplopia from EOM restriction / adherence
- 5/10 Eyelid retraction and diplopia
- 1/10 eyelid retraction only
- 6 Patients underwent removal of hardware
- Significant fibrosis / inflammation ~5mm away from mesh.

Alloplastic: Silicone

- Advantages:
  - Easy to work with
  - Smooth surface
  - Cheap

- Disadvantages:
  - Risk of migration
  - Inflammatory cyst / capsule formation
  - Not rigid

Laxenaire et al: 137 pts with silicone sheets in orbit.
- 19 (13.8%) required removal (migration, cellulitis, fistula, ...)

Alloplastic: PPE

- Medpor, Synpor
- Pores allow tissue ingrowth / vascularization / fixation.

- Advantages:
  - Easy to work with
  - No inflammatory capsule formation
  - Generally doesn't require fixation (stable)

- Disadvantages:
  - Expensive
  - Potential scarring / adherence to orbital tissues


Facial Skeletal Reconstruction Using Porous Polyethylene Implants

Michael J. Novosad, M.D.

Retrospective PPE Facial Implants
- 370 facial implants / 178 operations / 11 years
- 4 infections (1 paranasal, 3 malar)
- 145 = internal orbital implants (fracture / tumor rec)
- Zero of these required removal / revision
Alloplastic: Nylon Foil

- SupraFOIL
- Advantages:
  - Cheap
  - Thin
  - Easy to work with, pliable
- Disadvantages
  - Some risk of motility (decreased with screw fixation)
  - Not rigid


- 181 orbital fractures repaired with SupraFOIL,
  - All with at least one titanium screw fixation
  - F/u 3 days to 8.7 years (avg. 363 days)
  - 1 acute orbital hemorrhage (POD 2)
  - 2 late infections (POD 683; POD 984)
  - Conclude SupraFOIL to be safe
    - Safety improved by titanium screw fixation (decreased migration)

Composites

- Titanium plus porous polyethylene or nylon
- Medpor TITAN
- Synpor
Composites

- “barrier” sheets
- Non-porous surface overlay on porous polyethylene sheet:
  - Theoretically reduces risk of tissue adherence to porous surface
    - E.g., barrier surface faced to orbit / extraocular muscles
- M-T-M: Medpor – Titan – Medpor
- B-T-M: Barrier – Titan – Medpor
- B-T-B: Barrier – Titan – Barrier

29 y/o male R floor fx
- PO-Year 3: Medpor Titan B-T-M
- Awoke with hyperglobus and diplopia
- Implant / cyst / blood removed
- Replaced with Medpor Titan M-T-M

Conclusion

- Many options available for orbital fracture repair
- Autologous bone or cartilage was considered “gold standard”
  - Infrequently used due to time / second site
- Variety of alloplastic materials available
  - All with associated benefits and detriments
  - There is no “perfect” implant
References